$1.50

Simpson

INSTRUMENTS THAT STAY ACCURATE

OPERATOR'S MANUAL

UNIVERSAL TEMPERATURE ADAPTER
CATALOG NO. 00758

WARNING

For safe usage, it is essential that the operator read this manual carefully before using the instrument for any measurements.

SIMPSON ELECTRIC COMPANY

853 Dundee Ave., Elgin, Illinois 60120
Area Code 312, Telephone 697-2260
In Canada, Bach-Simpson, Ltd., London, Ontario

Warranty

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

ELECTRIC COMPANY
853 Dundee Ave., Elgin, Illinois 60120 Phone: (312) 697-2260
IN CANADA: Bach-Simpson, Ltd., London, Ontario
IN ENGLAND: Bach-Simpson (U.K.) Limited, Wadebridge, Cornwall
IN INDIA: Ruttonsha-Simpson Private, Ltd., International House, Bombay-Agra Road, Vikhroli, Bombay

OPERATOR'S MANUAL

UNIVERSAL TEMPERATURE ADAPTER CATALOG NO. 00758

SIMPSON ELECTRIC COMPANY
853 Dundee Ave., Elgin, Illinois 60120
Area Code 312, Telephone 697-2260
In Canada, Bach-Simpson, Ltd., London, Ontario

3C1178 (123.01)
EFFECTIVE DATE: Immediately
EDITION: 1st
Part No. 6-111062

TABLE OF CONTENTS

SECTION I

Introduction 1-1
- 1.1 General 1-1
- 1.2 Description 1-1
- 1.3 Technical Data 1-2

SECTION II

Installation 2-1
- 2.1 Unpacking and Inspection 2-1
- 2.2 Power Source Requirements 2-1
- 2.3 Warranty 2-1
- 2.4 Shipping 3-1
- 2.5 Mounting Instructions 3-1
- 2.6 Electrical Performance 3-1

SECTION III

Controls and Connections 3-1
- 3.1 General 3-1
- 3.2 Description 3-2

SECTION IV

Operating Instructions 4-1
- 4.1 General 4-1
- 4.2 Safety Precautions 4-1
- 4.3 Temperature Measurement Procedure 4-1

SECTION V

Theory of Operation 5-1
- 5.1 General 5-1
- 5.2 Basic Theory 5-1
- 5.3 Circuit Refinements 5-3

Table of Contents

SECTION VI

Operator Servicing 6-1
6.1 General 6-1
6.2 Battery Replacement 6-1
6.3 Abbreviated Operational Check 6-1

SECTION VII

Servicing Instructions 7-1
7.1 General 7-1
7.2 Accuracy Test and Calibration Procedure 7-1
7.3 Troubleshooting 7-2
7.4 Printed Circuit Component Replacement 7-3
7.5 Replacement Parts and Schematic Diagram 7-4

LIST OF TABLES

3-1 Description of Main Parts 3-2
7-1 Replacement Parts 7-4

LIST OF ILLUSTRATIONS

1-1 Adapter iv
1-2 Tester Connections and Adapter Leads 1-3
3-1 Main Parts of Temperature Adapter 3-2
5-1 Elementary Temperature Bridge 5-2
5-2 Refined Practical Bridge 5-5
7-1 Calibration Points 7-4
7-2 Schematic Diagram, Temperature Adapter 7-6

NOTE: This Operator's Manual contains information essential to the operation of this Instrument. Therefore, it should be kept in a convenient place and used for reference as required.

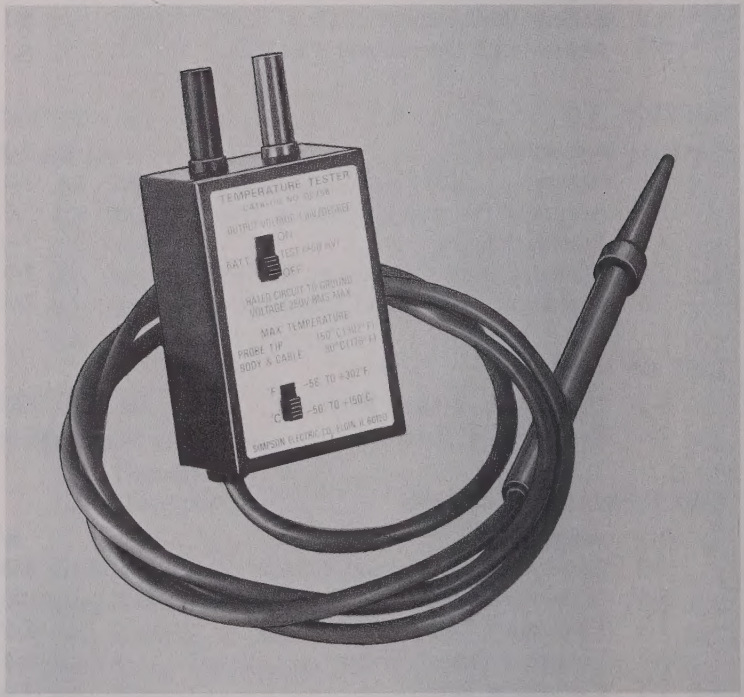


Figure 1-1. Adapter

WARNING

These Instruments are designed to prevent accidental shock to the operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely before making any measurements. Failure to follow directions can result in a serious or fatal accident.

SHOCK HAZARD: As defined in American National Standard, C39.5, Safety Requirements for Electrical & Electronic Measuring & Controlling Instrumentation, a shock hazard shall be considered to exist at any part involving a potential in excess of 30 volts rms (sine wave) or 42.4 volts DC or peak and where a leakage current from that part to ground exceeds 0.5 milliampere, when measured with an appropriate measuring instrument defined in Section 11.6.1 of ANSI C39.5.

NOTE: The proper measuring instrument for the measurement of leakage current consists essentially of a network of a 1500 ohm non-inductive resistor shunted by a 0.15 microfarad capacitor connected between the terminals of the measuring instrument. The leakage current is that portion of the current that flows through the resistor. The Simpson 229-Series 2 AC Leakage Current Tester meets the ANSI C39.5 requirements for the measurement of AC leakage current and can be used for this purpose. To measure DC Leakage current, connect 1500 ohm non-inductive resistor in series with the 260-6P 1mA Range.

SECTION I
INTRODUCTION

1.1 GENERAL

1.1.1 The Simpson Temperature Adapter (Catalog No. 00758) (hereafter referred to as the Adapter) is a convenient, accurate, and fast-responding device for monitoring surface temperatures. Its low thermal mass makes it useful for checking very small devices, such as electronic components. It has two ranges: —50° to +150° Celsius and —58° to +302° Fahrenheit. The desired range is selected with a switch located on the front panel (Figure 1-1).

1.1.2 The Adapter consists of a pencil-like probe which is touched to the surface to be checked. It is connected by four feet of cable to a circuit module, which converts temperature in degrees to DC voltage in millivolts. The output may be connected to any read-out which will display DC millivolts, such as a Digital Voltmeter, Analog Voltmeter, Graphic Recorder, Meter Relay, etc. The display in millivolts may then be read directly in degrees.

1.2 DESCRIPTION

1.2.1 This Adapter can be useful in electronic design, trouble-shooting, repair service, and other applications that require the rapid location of overheated components. It features a direct read-out that is switch-selectable in degrees Celsius or degrees Fahrenheit. It uses a common 9-volt transistor battery which is easily replaced and provides up to 750 hours of operation. A built in battery test feature (located on the front panel) prevents unexpected loss of power or faulty readings.

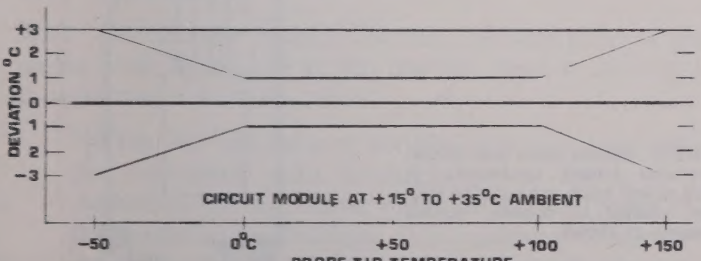
1.2.2 The Adapter is designed to allow insertion of banana jacks for many types of available test equipment. Special insulated female connectors are also provided to connect the temperature Adapter to the reverse lead configuration presently incorporated

on the Simpson 461 or 462 multimeter. A set of test leads is also included to connect the temperature adapter to other readout devices (Figure 1-2).

1.2.3 The Adapter has low output impedance, so it can be used with common VOMs (such as the Simpson 260). The low thermal mass of the probe tip makes it possible to obtain useful readings within a few seconds.

1.3 TECHNICAL DATA

1. Ranges (switch selected): —50° to +150° Celsius
   —58° to +302° Fahrenheit
2. Power Supply: 9V Alkaline Battery — NEDA 1604A or equivalent.
3. Battery Life: 750 hours
4. Output: One mV DC per degree C or F
5. Output Loading: 5,000 ohms minimum
6. Accuracy:

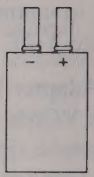


Add ± 1°C to above deviation for circuit module ambient of 0° to +15°C or +35° to +50°C.

7. Response Time: 1.5 seconds to within 2° of final reading with a step change of 50°C
8. Maximum Rated Circuit-to-Ground Voltage: 350V peak from probe tip to circuit common or earth ground.

Banana jack plug-in option for use with Simpson Digital Multimeters: 464, 465, 460-3 or other similiar types.

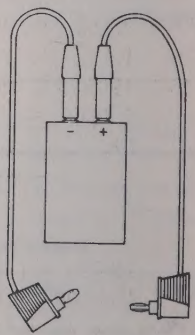
(Use on 200mV DC Range)



Insulated female plug-in option for use with Simpson 461 Digital Multimeters.

(Use on 200mV DC Range)

NOTE: Banana jacks and special insulated female connectors, as well as test leads, are supplied with the adapter to provide various options as shown.



Banana jack option with adapter leads for use with the Simpson 260-6 Analog Multimeter.

(Use on 50μA, 250mV DC Range)

Figure 1-2. Tester Connections and Adapter Leads

SECTION II
INSTALLATION

2.1 UNPACKING AND INSPECTION

2.1.1 Examine the shipping carton for obvious signs of damage prior to unpacking. If the shipping carton is in good condition, unpack and inspect the adapter for possible damage incurred during shipment. If damage is noted, notify the carrier and supplier and do not attempt further use of the adapter. If it appears to be in good condition, read the Operator's Manual in its entirety. Become familiar with the adapter as instructed in the manual, then proceed to check the electrical performance as soon as possible.

2.2 POWER SOURCE REQUIREMENTS

2.2.1 The Adapter is shipped with a 9V alkaline battery. For maximum battery life, the BATT Switch should always be in the OFF position when not in use.

2.3 WARRANTY

2.3.1 The Simpson Electric Company warranty policy is printed on the inside front cover of this manual. Read it carefully prior to requesting a warranty repair.

> **NOTE:** For assistance of any kind, including help with the Instrument under warranty, contact the nearest Authorized Service Center (listed on the last pages of this manual) for instructions. If it is necessary to contact the factory directly, give full details of any difficulty and include the catalog number (at the front of the adapter) and date of purchase. Service data or shipping instructions will be mailed promptly. If an estimate of charges for non-warranty or other services is required, a maximum charge estimate will be quoted. This charge will not be exceeded without prior approval.

2.4 SHIPPING

2.4.1 Pack the Instrument carefully and ship it prepaid to the proper destination. Insure the Instrument.

2.4.2 Save the shipping carton and packing materials for future storing or shipping of the Instrument.

2.5 MOUNTING INSTRUCTIONS

2.5.1 The banana jack or insulated female connectors (included in the accessory kit) are installed into the tester before use. (See Figure 1-2 for adaptation with various types of readout devices.) The Adapter should be located near the device to be measured to allow the probe and cable to reach easily. (The top surface of the Adapter should be visible, and the switches should be easy to operate.)

2.6 ELECTRICAL PERFORMANCE

2.6.1 After proper completion of visual inspection and connection to a Simpson 461, 462, or other readout device, check the electrical performance of the Adapter as explained in paragraph 6.3.

SECTION III
CONTROLS AND CONNECTIONS

3.1 GENERAL

3.1.1 The major parts of the temperature Adapter are shown in Figure 3-1 and described below. Become thoroughly familiar with them before using the Adapter .

3.2 DESCRIPTION

3.2.1 Description of the main parts of the Adapter are listed in Table 3-1 below.

Table 3-1. Description of Main Parts

1. Circuit Module:	Contains the circuit, battery, switches and connectors.
2. Cable:	Connects the circuit module with the probe.
3. Probe Body or Handle:	The portion grasped by the operator during use.
4. Probe Tip:	The temperature-sensitive part of the probe.
5. Connectors:	Output terminations to accept banana jacks or insulated female connectors (Figure 1-2).
6. Battery Switch:	Turns the adapter off, on, or to battery test mode.
7. °F/°C Switch:	Scales output to one millivolt per degree Celsius, or one millivolt per degree Fahrenheit.

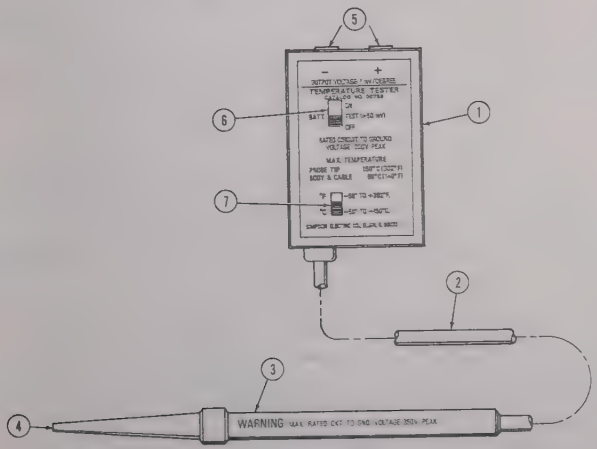


Figure 3-1. Main Parts of Temperature Adapter (Refer to Table 3-1)

SECTION IV
OPERATING INSTRUCTIONS

4.1 GENERAL

WARNING

Before proceeding with the operation of the adapter, review the SHOCK HAZARD definition at the front of this manual.

4.1.1 The Adapter measures the surface temperature of solid objects, and provides an output voltage of one millivolt per degree of temperature. A switch permits selection of Celsius or Fahrenheit scales.

4.2 SAFETY PRECAUTIONS

4.2.1 Do not touch the probe to any object which has a voltage greater than 350V peak with respect to ground.

4.2.2. Do not touch the probe tip to any object at a temperature higher than 150°C or 302°F.

4.2.3 Do not expose the probe handle or cable to temperatures higher than 60°C or 140°F.

4.3 TEMPERATURE MEASUREMENT PROCEDURE:

a. Review safety precautions in paragraph 4.2.
b. Connect the adapter to a Simpson 461 or 462 Digital Multimeter or other readout device (Figure 1-2).
c. Set the readout device to read millivolts DC.
d. Switch the BATT Switch (6) to test position. With a new battery in the adapter, the readout should indicate 100.0 mV or more.

NOTE: Replace the battery if the reading is less than 50.0 mV. (See paragraph 6.2.)

e. Set the °F/°C switch (7) to °F or °C, as desired.

f. Switch the BATT Switch (6) to the ON position. At normal room temperatures, the readout should indicate between 68.0 and 77.0°F or 20.0 to 25.0°C.

g. Touch the probe tip (4) to the surface to be tested, and hold it gently but firmly in contact with the tip flat on the surface.

h. When the display stabilizes, read it directly in °F or °C (depending on the setting of the °F/°C Switch [7]). A useful reading should be available within a few seconds, depending on the size of the object being tested and the quality of contact between its surface and the probe tip.

> **NOTE:** Readings may be made faster and easier by applying a small amount of thermally conductive compound, such as Dow Corning No. 340, or Wakefield Type 120, to the object to be tested.

i. When testing is completed, turn the BATT Switch (6) to the OFF position.

SECTION V
THEORY OF OPERATION

5.1 GENERAL

5.1.1 This section describes the theory of operation of the Temperature Adapter along with the basic theory and circuit refinements.

5.2 BASIC THEORY

5.2.1 The Adapter relies on the fact that the voltage across a semiconductor junction decreases (nearly) linearly with increasing temperature when the current is constant.

5.2.2 An elementary bridge circuit using this principle is shown

in Figure 5-1. The battery (symbolically illustrated) is assumed to provide constant voltage. At 0°C, the voltage across the diode (leg C of the bridge) is around 0.6V DC or 600mV DC. The zero adjustment is set to balance the bridge when the diode is at 0°C, making the voltage across leg A of the bridge exactly equal to the voltage across the diode in leg C; the voltage across the output terminals is 0.0mV.

5.2.3 As the temperature of the diode increases, the voltage across it decreases at a rate of approximately 2.5mV per degree C. This decrease makes the bottom end of leg C of the bridge more positive than the bottom of leg A, so the + output terminal becomes more positive. The span adjustment, together with the adjacent resistors, act as a voltage divider. It is adjusted so that the change of approximately 2.5mV/°C at the diode is divided down to exactly 1.0mV/°C at the output terminals.

5.2.4 If the diode temperature goes below 0°C, the diode voltage increases. This increase causes the voltage at the bottom of leg C to become more negative than the voltage at the lower end of leg A. Therefore, the output voltage is negative. Thus, temperatures below zero are read out as negative. For example, a temperature of 13½ degrees below 0°C would be read as —13.5.

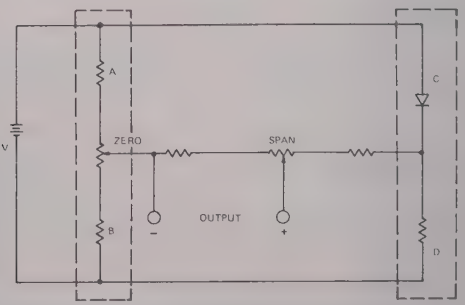


Figure 5-1. Elementary Temperature Bridge

5.3 CIRCUIT REFINEMENTS

5.3.1 Figure 5-2 illustrates some of the circuit refinements that make the semiconductor junction thermometer a truly practical, accurate, wide-range device.

5.3.2 A constant current field-effect diode is placed between the battery and the bridge circuit. Because the current into the bridge is constant, the voltage across it will always be constant, causing the terminal voltage to drop, even as the battery ages. This method of keeping bridge voltage constant is more stable than a zener diode. It also requires less battery power, resulting in longer battery life.

5.3.3 The temperature sensor which forms leg C of the bridge is replaced by a transistor, which improves linearity by reducing the influence of surface and carrier recombination effects.

5.3.4 An X1 buffer is placed between the zero adjust and the output branch of the bridge to eliminate loading effects, which could change the voltage at the lower end of leg A.

5.3.5 An X1 buffer is placed between the span adjustment and the output terminal to eliminate loading effects on the span.

5.3.6 The resistor in leg D is replaced with an operational amplifier. Since an operational amplifier has an extremely large voltage amplification, a very small voltage difference between the input terminals will drive it to full output. If a negative feedback path exists around the amplifier, any voltage at the output causes an input which opposes that output voltage; the amplifier tends to maintain nearly zero voltage difference between its inputs.

5.3.7 In Figure 5-2, the voltage divider in leg A provides a fixed reference voltage for the + (non-inverting) input of the operational amplifier, and for the base of the transistor temperature sensor in leg C. If there is no current flow in the transistor, the

collector is pulled up to the voltage at the top of the bridge by the resistor in leg C. This pull puts a positive voltage at the — (inverting) input of the operational amplifier, thus causing an inverted, or negative-going voltage at the output of the amplifier. This negative-going voltage reduces the voltage at the emitter of the transistor, driving it as a common-base amplifier and causing the collector current to rise.

5.3.8 If the transistor draws too much current, the collector voltage will become more negative than the base, by a small amount (normal with silicon transistors). This action causes the — (inverting) input of the amplifier to go negative, causing its output to go positive. Driving the base of a common-emitter NPN transistor positive reduces the collector current, which causes the collector to go positive. Thus, the — (inverting) input of the amplifier is driven in a positive direction.

5.3.9 In Paragraphs 5.3.7 and 5.3.8, the action of a negative feedback loop was described. The result of this action is to hold the inputs of the operational amplifier to a near zero voltage difference by driving the — (inverting) input to equal the voltage at the + (non-inverting) input.

5.3.10 The collector of the transistor is thus kept at the same constant voltage as the divider in leg A. Collector current is supplied through the resistor in leg C. Because the voltage across this resistor is held constant, the collector current does not change. (The constant collector current is one of the basic requirements for the temperature sensing transistor.)

5.3.11 The base and emitter are at the same voltage, so there is zero collector to base voltage difference. Collector to base leakage current, which could cause non-linearity, is eliminated.

5.3.12 Two additional refinements, not shown on the simplified schematic of Figure 5-2, may be found on the complete schematic

diagram, Figure 7-1. The first is a switch which selects either of two zero adjustments and either of two points on the span voltage divider. This switch selects the sensitivity output of either 1.0mV/°C or 1.0mV/°F. The second refinement is a built in battery test which displays the battery output under a normal load as a percentage of 9 volts. Thus, a new battery should read 100.0 or higher. When the battery test reads 50.0 or lower, the voltage is down to 50 percent. The battery must then be replaced.

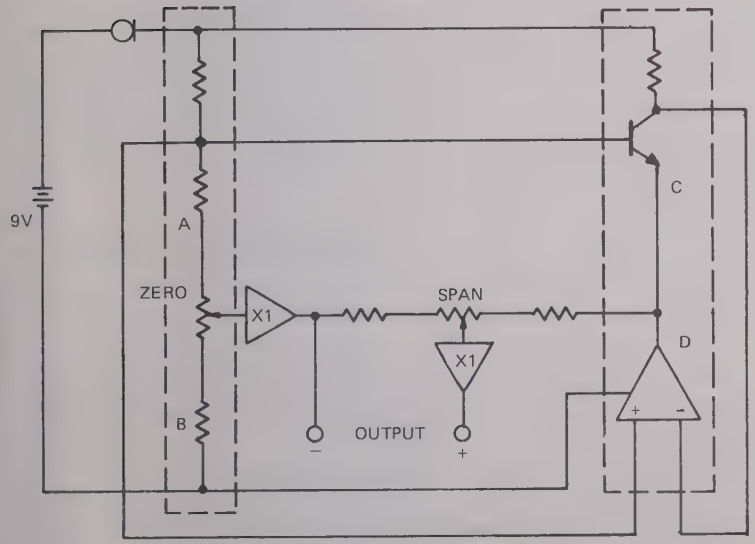


Figure 5-2. Refined Practical Bridge

SECTION VI
OPERATOR SERVICING

6.1 GENERAL

6.1.1 This section describes the necessary steps for replacing the battery of the Adapter and an abbreviated procedure for checking its operation.

6.2 BATTERY REPLACEMENT

6.2.1 Test the battery by following the temperature measurement procedure in paragraph 4.3, steps a through d. If the battery needs replacement, follow the procedure below:

a. Disconnect the adapter from the readout device.

b. Remove the four slotted head screws retaining the bottom cover and take off the cover.

c. Tap the adapter gently against the hand to loosen the battery. Slip the battery out. Be careful to avoid excessive stress on the connecting wires.

d. Disconnect the battery clip by hand. Do not pry it with tools, or cause added stress to the connecting wires.

e. Connect a new 9 volt alkaline battery (NEDA type 1604A) to the battery clip.

f. Slip the new battery into the case. (Be sure the insulating board lies between the battery and the printed circuit board.)

g. Dress the connecting wires against the battery so they will not be pinched between the cover and the circuit board or between the cover and the housing.

h. Replace the cover and the four retaining screws.

NOTE: If the Adapter is to be stored for more than two months, remove the battery.

6.3 ABBREVIATED OPERATIONAL CHECK

6.3.1 The following procedure will establish whether the Adapter

is functioning, but it does not test for adherence to the accuracy specifications. The procedure is as follows:

6.3.2

a. Follow the temperature measurement procedure in paragraph 4.3, steps a through d.

b. Fasten a thermometer which will indicate ambient temperature to the probe body (item 3, Figure 3-1) with a rubber band, so the thermometer bulb is next to the probe tip (item 4, Figure 3-1). Let the probe and thermometer adjust to room temperature for five minutes.

c. Follow steps e and f of paragraph 4.3. The readings on the thermometer and tester should normally agree within two degrees Fahrenheit or one degree Celsius.

d. Touch the probe tip with a warm finger. The readout should indicate a rapid rise in temperature within one or two seconds.

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

SECTION VII
SERVICING INSTRUCTIONS

7.1 GENERAL

7.1.1 This section explains the accuracy testing and calibration procedures, troubleshooting, printed circuit component replacement, replacement parts and schematic diagram.

7.2 ACCURACY TEST AND CALIBRATION PROCEDURE

7.2.1 The following procedure will check the performance of the Adapter with its accuracy specifications. If it deviates from the specifications, re-calibration may be performed under the following procedures (Figure 7-1 shows the calibration points):

Equipment Required:

Stirred ice water bath

ASTM Type 89C* thermometer or equivalent
—20 to 10°C ±.1°C

Boiling water bath

ASTM Type 94C* thermometer or equivalent
+80 to 110°C ±.1°C

Simpson 461 Digital Multimeter or equivalent

a. Follow the temperature measurement procedure, paragraph 4.3, steps a through f.

b. Set the °F/°C Switch (item 7, Figure 3-1) to °C and put the probe tip (item 4, Figure 3-1) in the ice bath to a depth of no more than 2 inches.

c. Monitor the stirred ice bath with the ASTM 89C thermometer, and let the probe temperature stabilize for at least one minute. The adapter readout should agree with the thermometer within 1.0°C.

** Describes type, range, accuracy of thermometers briefly.*

d. If the Adapter is not within 1.0°C, remove the four screws and the bottom cover. Carefully adjust the °C zero (Figure 7-1) so the readout agrees with the thermometer.

e. Put the probe tip into the boiling water to a depth of no more than 2 inches. Monitor the boiling water with the ASTM 94C thermometer.

f. Let the probe tip stabilize in the boiling water for at least one minute. The adapter readout should agree with the thermometer within 1.0°C.

g. If the Adapter is not within 1.0°C, adjust the span adjustment (Figure 7-1) so the readout agrees with the thermometer.

h. Return the probe tip to the stirred ice water and let it stabilize for at least one minute.

i. Set the °F/°C switch to °F. Read the thermometer; multiply the reading by 9/5 and add 32. The adapter readout should agree with the result (within 1.8°F).

j. If the Adapter is not within 1.8°F, set the 32°F set adjustment (Figure 7-1) to agree with the figure obtained in step i above.

k. Repeat steps b through j above.

l. Turn the BATT switch to OFF.

7.3 TROUBLESHOOTING

7.3.1 The schematic diagram (Figure 7-2), together with Section V, Theory of Operation, form the basis of any troubleshooting effort. Voltages shown on the schematic are typical, and will vary from unit to unit. If assistance is needed contact the nearest Authorized Service Center.

> **NOTE:** Any defective components must be replaced only with the correct part as listed in Table 7-1. Particular care must be taken when replacing components

on the printed circuit board. Be sure to follow the procedures outlined in paragraph 7.5.

7.4 PRINTED CIRCUIT COMPONENT REPLACEMENT

7.4.1 Component lead holes in the circuit board are plated through to ensure good electrical contact between conductors on the opposite side of the board. To prevent damage to this plating and to the replacement component, apply heat sparingly and work carefully. The following replacement procedure is recommended.

a. Remove defective equipment.

b. Melt solder in component lead holes. Use a clean, dry soldering iron and solder wick to remove excess solder. Clean holes with a toothpick or wooden splinter. Do not use a metal tool for cleaning, as it may damage the hole plating.

c. Carefully bend the leads of the replacement component to the correct shape, and insert the component into the component lead holes. Using heat and solder sparingly, solder leads in place. Heat may be applied to either side of board. A heat sink (long-nose pliers, commercial heat-sink tweezers, etc.) must be used when replacing semiconductors, in order to prevent conduction of excessive heat from the soldering iron to the component.

d. Hole plating breaks are indicated by the separation from the board of the round conductor pad on either side of the board. To repair breaks, press conductor pads against board, and solder replacement component lead to conductor pad on both sides of the board.

NOTE: This Adapter must be serviced by qualified personnel. To aid in troubleshooting, a schematic diagram is enclosed. The accompanying parts list (Table 7-1) describes the components and refers to Simpson

part numbers. Reference Symbol numbers correlate the components shown on the schematic diagram with the parts list.

7.5 REPLACEMENT PARTS AND SCHEMATIC DIAGRAM

7.5.1 The following information is provided as an adjunct to the overall text contained in this manual and should be read and understood thoroughly prior to ordering replacement parts for the Instrument.

7.5.2 To obtain replacement parts, address order to the nearest Authorized Service Center (listed on the last pages of this manual). Refer to paragraph 2.3 for ordering instructions.

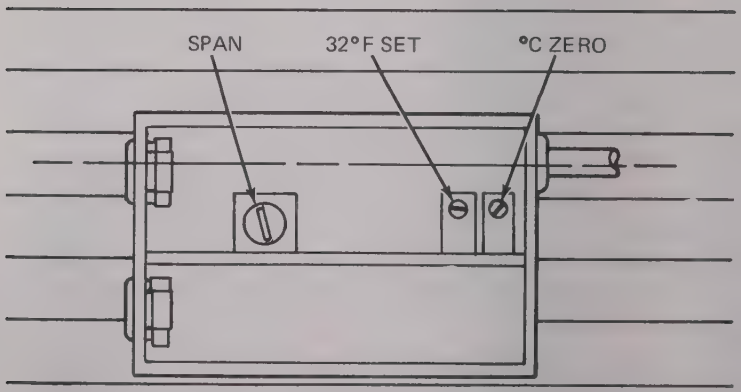


Figure 7-1. Calibration Points

Table 7-1. Replacement Parts

Symbol	Description	Part No.
	Replacement Probe Assembly	10-830729
	Circuit Board Assembly, Complete	10-864110
	Instruction Manual	6-111062
	Battery Clip	6-110968
	Output Connector, Red	10-864134
	Output Connector, Black	10-864135
	Battery, 9V Alkaline* (NEDA type 1604A)	5-114907
	Insulating Board	3-812603
	Strain Relief Bushing	6-111027
IC1	Integrated Circuit	6-110962
D1	Regulating Diode	6-110965
C1 thru C6	0.1μF Capacitor	6-110525
VR1, VR2	2k Variable Resistor	5-117691
VR3	20k Variable Resistor	6-111098
R1	9.76k 1% Resistor	5-115626
R2, R3, R4	1.43k 1% Resistor	5-117669
R5	499k 1% Resistor	5-110223
R6	5.76k 1% Resistor	5-115504
R7	17.4k Resistor	5-117272
R8	750k 5% Resistor	6-110966
R9	75k 5% Resistor	5-119768
R10	15.0k 0.1% Resistor	6-110971
R11	18.75k 0.1% Resistor	6-110970
	Banana Jacks	1-118071

** Available anywhere batteries are sold.*

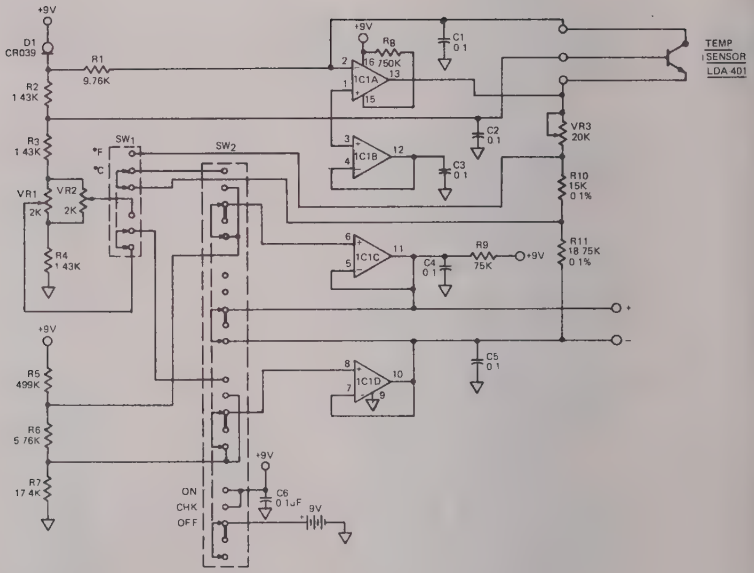


Figure 7-2. Schematic Diagram, Temperature Adapter

AUTHORIZED SERVICE CENTERS

SIMPSON ELECTRIC COMPANY

853 Dundee Avenue, Elgin, Illinois 60120 — Phone: (312) 697-2260

★ Parts Sales & Repair Service Only

★★ Parts, General Test Equipment & Panel Instrument Sales & Service

★★★ Same Service As (★★) Above Plus Panel Instrument Modification

★★★☐ Additionally Authorized for Service on Recorders, Controllers, Digital Products and Lab Portables

★★★ALABAMA, MOBILE 36617
☐ BROWNELL-ELECTRO INC.
3450 Armour Drive
Tel. 205/479-8581

★ALASKA, ANCHORAGE 99501
YUKON RADIO SUPPLY, INC.
3222 Commercial Drive
P.O. Box 406
Tel. 907/277-1497

★ALASKA, ANCHORAGE 99500
R. M. ZOOK & ASSOCIATES
1710 E. 27th Avenue
Tel. 907/272-6917

★ALASKA, FAIRBANKS 99701
YUKON RADIO SUPPLY, INC.
1112 Cushman Street
Tel. 907/452-1011

★★★ARIZONA, PHOENIX 85040
☐ METERMASTER INC.
4134 E. Wood Street
Tel. 602/243-4111

★★★CALIFORNIA, GLENDALE 91201
☐ WEATHERFORD INSTRUMENT DIV.
WESTERN ELECTRONIC SUPPLY CORP.
640 Allen Street
Tel. 213/246-4861

★★CALIFORNIA, LOS ANGELES 90040
☐ E.I.L. INSTRUMENTS INC.
6212 Peachtree St.
Tel. 213/685-7020

★★★CALIFORNIA, LOS ANGELES 90040
☐ METERMASTER, INC.
5646 Jillson Street
Tel. 213/685-4340

★★★CALIFORNIA, PALO ALTO 94303
☐ METERMASTER, INC.
3995 E. Bayshore Road
Tel. 415/968-0313

★★★CALIFORNIA, SAN DIEGO 92123
☐ METERMASTER/SAN DIEGO
8799 Balboa Avenue
Tel. 714/560-4841

★★★CALIFORNIA, SAN FRANCISCO 94105
PACIFIC ELECTRICAL
INSTRUMENT LAB
150 Folsom
Tel. 415/543-3104

★★★CALIFORNIA, SANTA CLARA 95050
☐ FISHER-BROWNELL
3381 Edward Avenue
Tel. 408/988-6041

★★★CALIFORNIA, SOUTH PASADENA 91030
☐ ETALON COMPANY
1323 Huntington Drive
Tel. 213/257-5410

★★★COLORADO, DENVER 80223
☐ METER MASTER INSTRUMENT
CORPORATION
1165 S. Cherokee
Tel. 303/722-5766

★★★CONNECTICUT, MIDDLETOWN 06457
☐ THE MANCIB COMPANY
Subsidiary of E.I.L. Instruments
Randolph Road and Coe
Tel. 203/346-6646

★★FLORIDA, MIAMI 33136
FLORIDA PRECISION INSTRUMENT
COMPANY
800 N.W. 7th Avenue
Tel. 305/324-1731

★★★FLORIDA, MIAMI 33142
☐ KIMBALL ELECTRONIC LAB., INC.
3620 N.W. 48 Terrace
Tel. 305/635-9712

★★★FLORIDA, ORLANDO 32806
☐ BROWNELL-ELECTRO INC.
307 27th St., Box 8945
Tel. 305/843-6775

★★FLORIDA, TAMPA 33614
TAMPA INSTRUMENTATION CENTER
A.C. FERNANDEZ ELECTRIC
4807 N. Church Avenue
Tel. 813/870-0183

★★★GEORGIA, ATLANTA 30354
☐ BROWNELL-ELECTRO INC.
3020 Commerce Way
Tel. 404/762-5181

★★HAWAII, HONOLULU 96819
EMC CORPORATION
2979 Ualena Street
Tel. 808/847-1138

★★**HAWAII, HONOLULU 96819**
KEMS INCORPORATED
239 Puuhale Road
Tel. 808/847-1395

★★★**ILLINOIS, BRIDGEVIEW 60455**
E.I.L. INSTRUMENTS, INC.
9708 Industrial Drive
Tel. 312/430-2292

★★★**ILLINOIS, ELK GROVE VILLAGE 60007**
METERMASTER, INC.
121 Gordon Street
Tel. 312/593-8650

★★★**ILLINOIS, OAK PARK 60302**
PACIFIC INDICATOR COMPANY
6603 W. North Avenue
Tel. 312/261-1330

★★★**INDIANA, EVANSVILLE**
☐ ELECTRO-LAB SERVICES INC.
1302 N. Fulton 47710 (UPS)
P.O. Box 6011 47712 (MAIL)
Tel. 812/423-5211

★★**KANSAS, OVERLAND PARK 66206**
BROOKS ELECTRONICS INC.
3761 W. 95th Street
Tel. 913/648-3131

★★★**KANSAS, WICHITA 67211**
☐ MAIN ELECTRONICS INC.
225 Ida
Tel. 316/267-3581

★★★**LOUISIANA, HARAHAN 70123**
☐ INDUSTRIAL INSTRUMENT WORKS
134 Laitram Lane
Tel. 504/733-8355

★★★**MARYLAND, ELKRIDGE 21227**
☐ SUNSHINE SCIENTIFIC INSTRUMENTS, INC.
5800 Main Street
Tel. 301/796-5600

★★★**MARYLAND, GAITHERSBURG 20760**
☐ PIONEER/INSTRUMENTATION
Div. of Pioneer Standard Electronics Inc.
9100 Gaither Road
Tel. 301/948-0710

★★★**MARYLAND, SAVAGE 20863**
☐ INSTRUMENT SPECIALTIES INC.
Div. of Pyttronic Ind.
8220 Wellmoor Court
Tel. 301/792-0780

★★★**MARYLAND, TIMONIUM 21093**
☐ E.I.L. INSTRUMENTS, INC.
1830 York Road
Tel. 301/252-1260

★★**MASSACHUSETTS, BILLERICA 01821**
METERMASTER, INC.
13 Fortune Drive
Tel. 617/667-8346

★★★**MASSACHUSETTS, BURLINGTON 01803**
☐ THE MANCIB COMPANY
Subsidiary of E.I.L. Instruments Inc.
21 "A" Street
Tel. 617/272-9450

★★★**MICHIGAN, FERNDALE 48220**
☐ RAM METER, INC.
1100 Hilton Road
Tel. 313/398-6767

★★★**MINNESOTA, MINNEAPOLIS 55427**
☐ INSTRUMENTATION SERVICES INC.
957 Winnetka Avenue North
Tel. 612/544-8916

★★★**MISSOURI, ST. LOUIS 63108**
☐ INDUSTRIAL SERVICE LABORATORIES CORP.
4354 Olive Street
Tel. 314/535-5760

★★★**MISSOURI, ST. LOUIS 63143**
☐ SCHERRER INSTRUMENTS INC.
7170 Manchester
Tel. 314/644-5362

★★**MONTANA, BILLINGS 59102**
INDUSTRIAL ELECTRONICS & AUTOMATION COMPANY
2500 Grand Avenue
Tel. 406/656-1313

★★**NEBRASKA, LINCOLN 68508**
ELECTROMETRICS COMPANY
404 South 11th
Tel. 402/477-3434

★★★**NEW JERSEY, BELLEVILLE 07109**
MARSHALL INSTRUMENTS INC.
236 Washington Avenue
Tel. 201/751-1190

★★★**NEW JERSEY, SOUTH PLAINFIELD 07080**
BROWNELL-ELECTRO INC.
500 Hadley Road
Tel. 201/753-4600

★★★**NEW MEXICO, ALBUQUERQUE 87102**
☐ MISSOURI RESEARCH LAB, INC.
630 Haines Avenue NW
Tel. 505/243-6772

★★★**NEW YORK, CHADWICKS 13319**
MOHAWK COMMUNICATIONS
3500 Bleachery Place
Tel. 315/737-7328

★★★**NEW YORK, CHADWICKS 13319**
MOHAWK COMMUNICATIONS
3500 Bleachery Pl.
Tel. 315/737-7328

★★★**NEW YORK, CLARENCE 14031**
☐ TROTT ELECTRONICS INC.
9020 Wehrle Drive
Tel. 716/634-8500

★★★**NEW YORK, NEW YORK 10011**
BROWNELL-ELECTRO INC.
85 Tenth Avenue
Tel. 212/924-6000

★★★**NEW YORK, NEW YORK 10011**
☐ NILSSON ELECTRICAL LABORATORY, INC.
111 8th Avenue — Rm. 1525
Tel. 212/675-7944

★★★**NEW YORK, ROCHESTER**
☐ ELECTRONIC INSTRUMENT COMPANY
325 Mt. Read Blvd.
Tel. 716/328-4350

★★★**NORTH CAROLINA, CHARLOTTE 28216**
☐ BROWNELL-ELECTRO INC.
5141 Belhaven Blvd.
Box #16368
Tel. 704/394-4341

★★★**NORTH CAROLINA, RALEIGH 27612**
☐ INSTRUMENT TECHNICAL REP.
Rt. 8 — Box 115-C1
Umstead Industrial Park
Tel. 919/781-5256

★★★**OHIO, CLEVELAND 44105**
☐ PIONEER/INSTRUMENTATION INSTRUMENT LABORATORY
Div. of Pioneer-Standard Electronics, Inc.
4800 East 131st Street
Tel. 216/587-3600

★★★**OHIO, CLEVELAND 44135**
☐ WESCHLER ELECTRIC CORP.
16900 Foltz Parkway
Tel. 216/238-2550

★★**OHIO, COLUMBUS 43229**
CONTRONICS, INC.
835 Busch Court
Tel. 614/846-5930

★★★**OHIO, DAYTON 45404**
☐ PIONEER/DAYTON
Div. of Pioneer-Standard Electronics, Inc.
1900 Troy Street
Tel. 513/236-9900

★**OKLAHOMA, OKLAHOMA CITY 73107**
HUSTON LABORATORIES, INC.
536 No. Pennsylvania
Tel. 405/235-5469

★**OKLAHOMA, TULSA 74120**
AGRA ENGINEERING COMPANY
551 S. Quaker Avenue
Tel. 918/584-4235

★★★**OREGON, PORTLAND 97217**
☐ WESTCON, INC.
5101 N. Interstate
Tel. 503/283-0132

★★★**PENNSYLVANIA, PHILADELPHIA 19115**
☐ SUNSHINE SCIENTIFIC INSTRUMENTS INC.
1810 Grant Avenue
Tel. 215/673-5600

★★★**PENNSYLVANIA, PITTSBURGH 15238**
CAM/RPC
620 Alpha Drive RIDC Pk.
Tel. 412/782-3770

★★★**PENNSYLVANIA, PITTSBURGH 15221**
☐ E.I.L. INSTRUMENTS, INC.
1844 Ardmore Blvd.
Tel. 412/731-5230

★★★**TENNESSEE, MEMPHIS 38116**
☐ BROWNELL-ELECTRO INC.
3053 Tranquility Drive
Tel. 901/332-9258

★★**TENNESSEE, MEMPHIS 38104**
INSTRUMENT REPAIR SERVICE
468 N. Watkins
Tel. 901/278-0762

★★★**TENNESSEE, NASHVILLE 37210**
☐ BROWNELL-ELECTRO INC.
1050 Acorn Drive
Tel. 615/889-8230

★★★**TEXAS, DALLAS 75220**
☐ ULTRA INSTRUMENT LAB., INC.
9995 Monroe
Tel. 214/357-0297

★★★**TEXAS, EL PASO 79901**
BORDER ELECTRONICS
1704 E. Paisano Drive
Tel. 915/532-2524

★★★**TEXAS, GARLAND 75040**
METERMASTER, INC.
2809 National Drive
Tel. 214/271-5671

★★★**TEXAS, HOUSTON 77006**
☐ ELECTRICAL INSTRUMENT METER COMPANY (EIMCO)
1424 Westheimer
Tel. 713/526-6871 & 72

★★★**TEXAS, HOUSTON 77023**
☐ METERS & INSTRUMENTS CORP.
6428 Gulf Freeway
Tel. 713/644-1631

★★**TEXAS, ODESSA 79760**
METER SERVICE & SUPPLY
2127 Kermit Highway
P.O. Box 2373
Tel. 915/332-0565

★★★**TEXAS, ODESSA 79760**
☐ WHITLOCK INSTRUMENT
1306 North Texas
Tel. 915/337-3412

★★★**VIRGINIA, ALEXANDRIA 22312**
☐ E.I.L. INSTRUMENTS, INC.
5400 Cherokee Avenue
Tel. 703/354-4330

★★★**VIRGINIA, CHESAPEAKE 23325**
☐ INSTRUMENT TECHNICAL REP.
1835 Lockhard Street
Tel. 804/424-5121

★★★**VIRGINIA, RICHMOND 23234†**

★★★**VIRGINIA, CHESTERFIELD 23831††**
☐ INSTRUMENT TECHNICAL REPRESENTATIVES
7400 White Pine Road
Tel. 804/275-1431

★★★**WASHINGTON, SEATTLE 98105**
☐ EICHER-RICHARDS COMPANY
2727 N.E. Blakeley Street
Tel. 206/523-7888

★★★**WASHINGTON, SEATTLE 98108**
E.I.L. INSTRUMENTS, INC.
1312 S. 96th Street
Tel. 206/762-0880

★★**WASHINGTON, SPOKANE 99202**
BLACKS-INDUSTRIAL INC.
N. 401 Helena
P.O. Box 3286
Tel. 509/535-1504

★★★**WISCONSIN, MILWAUKEE 53202**
THE ELECTRO MECHANO COMPANY
241 East Erie Street
Tel. 414/272-4050

★★**WYOMING, LANDER 82520**
METER SPECIALISTS, INC.
P.O. Box 595 (MAIL)
Hiway 287 West (UPS)
Tel. 307/332-9711

---

† *Regular Mail Delivery*
†† *UPS Delivery*

NOTES

NOTES

NOTES

Quality is the indispensable component
of every Simpson instrument . . . . . .